REMARKS

This is in response to the Office Action of December 29, 2006. Claims 23 and 75 are amended based upon such disclosure as that in the last full paragraph on page 22 of the specification ("... the particle diameter is limited to the range of requirement (a-1), whereby the interaction can be increased to prevent occurrence of the decrease in decomposition temperature ..."). New claims 76 and 77 are added, based upon such disclosure as that in the first full paragraph on page 31 of the specification ("These molded articles can be produced by a method in which the gas generating composition is mixed with water ... and the mixture is extrusion-molded (molded articles in the form of a single-perforated cylinder and a perforated (porous) cylinder) or by a compression-molding method using a pelletizer (molded article in the form of pellets)."). Claims 23, 24, 29, 30, 34, 39, 40, 50-52, 65, 67-69, 73, and 75-77 are pending in the application, of which claims 50-52, 65, and 69 stand withdrawn from consideration.

Interview

Applicants express their gratitude to Examiner Felton for the courtesies extended to their representative, Richard Gallagher, during an interview on April 24, 2007. The substance of the interview is reflected in the discussions that follow.

The invention

As demonstrated in the present specification, compositions of the present invention have excellent thermal stability. For instance, even after standing in a high temperature atmosphere for 10 or more years, they do not decompose. Specification, page 12, first full paragraph. With respect to the molded articles of claim 76, Applicants note that molded articles obtained by adding water to the gas generating composition are superior to otherwise comparable molded articles made without water, particularly with respect to combustion speed. As illustrated in Exhibit A, it is believed that guanidine nitrate (GN) is present in close contact around a basic copper nitrate (BCN) particle in the articles molded with water. In contrast, when water is not added, GN and BCN are not in such close contact. The June 21, 2007 'Declaration under 37 CFR

1.132' of Jianzhou Wu enclosed herewith compares molded articles in accordance with claim 73 with control articles having no added water. Typically, molded articles made in accordance with the present invention have combustion speeds of approximately 11-13 cm/millisecond, whereas comparable articles molded without water have combustion speeds of only about 8-10 cm/millisecond. With the specific molded articles shown in the June 21, 2007 Wu Declaration, the inventive molded articles have burning rates of 12.72 mm/sec and 11.81 mm/sec, which the corresponding comparative molded articles having burning rates of only 9.51 mm/sec and 8.58, respectively. This difference – significantly increased speed of combustion (burning rate) – constitutes an unexpected improvement provided by the invention of claim 76.

Rejection of claims over Barnes and Timmerman

Claims 23, 24, 29, 30, 34, 39, 40, 73, and 75 are rejected over US 5,608,183 (Barnes) in view of US 3,902,934 (Timmerman). Office Action, pages 2-3. The rejection is respectfully traversed. MPEP 2143 indicates that, to establish a *prima facie* case of obviousness, three basic criteria must be met. (1) There must be some suggestion or motivation – in the prior art, not in Applicants' disclosure – to modify the references or to combine the reference teachings. (2) There must be a reasonable expectation of success. (3) The prior art references must teach or suggest all of the limitations of each claim rejected. Those criteria are not met in the present rejection.

It is improper to combine Timmerman with Barnes. Timmerman shows an organic acid, such as citric acid, as a fuel. Barnes shows BCN as an oxidant. If a simple combination of Timmerman with Barnes is tested with added water, decomposition will take place due to a reaction between citric acid and BCN in the heating and drying step, resulting in production of a product mixture that is not useful as a gas generating agent. The technologies of Timmerman and Barnes are mutually incompatible. This point is supported by the September 27, 2007 Declaration of Jianzhou Wu, filed herein on October 10, 2006.

The compositions of the present invention are unexpectedly improved with respect to the closest prior art compositions because the present compositions – due to their requirement of basic metal nitrate particle diameters in the range 0.5 to 40 μm – have significantly better thermal resistance or ignition properties. Neither Barnes nor Timmerman teaches of suggests

that improvement in thermal resistance can be obtained by adjusting BCN particle diameters. Accordingly, this rejection over Barnes in view of Timmerman as it is stated by the Examiner fails to meet the suggestion or motivation test set forth in MPEP 2143.

Moreover, the rejection stated in the previous Office Action contains faulty logic. Persons of ordinary skill in the art know that particle size cannot be evaluated independently of the compounds or compositions having the particle size. $KCLO_4$ with a particle size of 10 μm and BCN with a particle size of 10 μm have different technical significances with respect to one another. If it is supposed that Timmerman suggests 25 μm or less than 10 μm as an oxidant's particle size, that does not suggest to a person of ordinary skill in the art that BCN particle size in Barnes should be 25 μm or less than 10 μm. With respect to the present invention, too small a particle size is undesirable in a gas generating agent. See page 22 of the specification: "When the particle diameter of BCN is too small, ... there occur influences such as a decrease in decomposition temperature and the like. Accordingly, the particle diameter is limited to the range of requirement (a-1), whereby the interaction can be decreased to prevent occurrence of the decrease in decomposition temperature and the like." Timmerman, on the contrary, teaches that particle size of the oxidant is preferably as small as possible. This indicates that the Timmerman teaching with respect to particle size is not applicable to Barnes nor to the present invention.

Rejection of claims over Mendenhall and Timmerman

Claims 23, 24, 29, 30, 34, 39, 40, 73, and 75 are rejected over US 5,841,065 (Mendenhall) in view of Timmerman. Office Action, pages 3-4. The rejection is respectfully traversed.

MPEP 2143 indicates that, to establish a *prima facie* case of obviousness, three basic criteria must be met. (1) There must be some suggestion or motivation – in the prior art, not in Applicants' disclosure – to modify the references or to combine the reference teachings. (2) There must be a reasonable expectation of success. (3) The prior art references must teach or suggest all of the limitations of each claim rejected. Those criteria are not met in the present rejection.

The compositions of the present invention are unexpectedly improved with respect to the closest prior art compositions because the present compositions – due to their requirement of basic metal nitrate particle diameters in the range 0.5 to 40 μm – have significantly better thermal resistance or ignition properties. Neither Mendenhall nor Timmerman teaches of suggests that improvement in thermal resistance can be obtained by adjusting BCN particle diameters. Accordingly, this rejection over Mendenhall in view of Timmerman as it is stated by the Examiner fails to meet the suggestion or motivation test set forth in MPEP 2143.

Moreover, the rejection stated in the previous Office Action contains faulty logic. Persons of ordinary skill in the art know that particle size cannot be evaluated independently of the compounds or compositions having the particle size. $KCLO_4$ with a particle size of 10 μm and BCN with a particle size of 10 μm have different technical significances with respect to one another. If it is supposed that Timmerman suggests 25 μm or less than 10 μm as an oxidant's particle size, that does not suggest to a person of ordinary skill in the art that BCN particle size in Mendenhall should be 25 μm or less than 10 μm. With respect to the present invention, too small a particle size is undesirable in a gas generating agent. See page 22 of the specification: "When the particle diameter of BCN is too small, ... there occur influences such as a decrease in decomposition temperature and the like. Accordingly, the particle diameter is limited to the range of requirement (a-1), whereby the interaction can be decreased to prevent occurrence of the decrease in decomposition temperature and the like." Timmerman, on the contrary, teaches that particle size of the oxidant is preferably as small as possible. This indicates that the Timmerman teaching with respect to particle size is not applicable to Mendenhall nor to the present invention.

Rejection of claims 67, 68, and 73

Claims 67, 68, and 73 are rejected over Barnes in view of Timmerman and US 5,780,767 (Matsuda) or US 6,468,369 (Zhou) or US 5,834,679 (Seeger). Office Action, page 4. Claims 67, 68, and 73 are rejected over Mendenhall in view of Timmerman in view of Matsuda or Zhou or Seeger. Office Action, pages 4-5. The rejections are respectfully traversed.

The Examiner admits that Barnes and Mendenhall fail to disclose or suggest the sodium carboxymethylcellulose component of the presently claimed compositions, but argues that the

ancillary references are suggestive of substituting sodium carboxymethylcellulose for the guar gum of the primary references.

The primary references indicate that gas generating compositions should be non-toxic. See e.g. Barnes, column 1, lines 13-25. Matsuda, on the other hand, shows an azide compound or an organic compound such as a dicyandiamide as a fuel. The use of azide compounds as in Matsuda is directly contrary to the teaching of the primary references regarding non-toxicity. Therefore the combination of Matsuda with Barnes or Mendenhall is improper. Also, dicyandiamide is reactive with BCN, so that the use of such compounds is impossible in gas generating compositions.

Zhou shows a phase stabilized ammonium nitrate having a very low melting point. If this compound is used in a gas generating composition, combustion must be effected at a high pressure. For this reason, it is not proper to combine Zhou with Barnes or Mendenhall. The combustion disclosed by the primary references will not be obtained with the suggested combination of Barnes or Mendenhall with Zhou. Applicants note that compositions of the present invention can have a pressure exponent of 0.32, whereas the Zhou compositions have a pressure exponent of 0.42 to 0.85. The correlation between burning rate and burning pressure is $r = a \times P^n$, in which "n" is a pressure exponent (pressure index) and "a" is a constant depending on the kind of gas generating agent. In gas generating agents having a small value of "n", the burning rate does not change greatly even with small changes in the pressure P. Gas generating agents having large "n" values change greatly in burning rate, depending on pressure changes during combustion and changes in the inner pressure of the inflator caused by ambient temperatures. It is difficult to obtain good gas generating agents having high burning rates. In other words, the larger the pressure exponent is, the more difficult it is to control the combustion property, and unexpected deployment of air bags caused by excess pressure output may injure people.

Seeger shows an auto ignition material (AIM) composition, where the AIM composition is placed in a combustion chamber but separated from a gas generating agent, as shown in Seeger's Figures 2-5. The amount of the AIM composition is 60 to 150 mg and the composition contains about 1% to 50% (0.6 to 75 mg) of a binder. The auto ignition material is used in a small amount separately from a gas generating agent. When a car with an air bag system that

includes AIM is involved in a fire, the AIM will burn automatically before the housing is heated to the point where it loses strength and breaks up. If no AIM is included, the housing will be heated by the fire to the point where it loses strength and the gas generating agent will then burn and break the weakened housing, potentially injuring passengers.

Even assuming that the ancillary references serve to establish a *prima facie* case of obviousness with respect to the invention of claims 67, 68, and 73 – as was pointed out in the Interview mentioned above – the Declaration of Dr. Wu filed herein on April 2, 2004 clearly established that unexpected beneficial properties (reduced carbon monoxide emissions) are provided by the invention of claims 67, 68, and 73. Examiner Felton indicated that Applicants' argument, that the *prima facie* case of obviousness is rebutted by this Declaration, appears to be correct. The Examiner indicated that if data from the Declaration were to be reproduced in the present Remarks, it would make it easier for her to fully evaluate our position and possibly withdraw the rejection of these claims. The March 24, 2004 Declaration under 37 CFR 1.132 of Dr. Jianzhou Wu provides evidence of the unexpected superiority of the compositions of the present invention as compared to the properties of the compositions of the primary references. The Declaration demonstrates that the presently claimed compositions surprisingly generate significantly smaller amounts of noxious carbon monoxide gas than do the corresponding prior art compositions. Specific data from the Declaration is as follows:

	Comparison C	Invention A	Comparison D	Invention B
Composition	GN/BCN/GG 41.1/58.9/5.3 *Barnes '183*	GN/BCN/CMCNa 42.4/57.6/5.3 *present invention*	GN/BCN/GG 42.1/52.9/5.0 *Barnes '183*	GN/BCN/CMCNa 43.4/51.6/5.0 *present invention*
Oxygen balance (g/g)	0.008	0.008	-0.009	-0.009
Burning rates (mm/sec)				
@ 50 kg/cm^2	9.41	9.31	9.85	8.90
@ 70 kg/cm^2	10.22	10.38	10.88	9.77
@ 90 kg/cm^2	11.43	11.26	11.53	10.74
Pressure exponent	0.33	0.32	0.27	0.32
Amount of discharged CO (ppm)				
NO_2	0	0	0	0
NO	170	145	65	70
CO	440	215	500	220
NH_3	2	4	10	6.5
total	612	364	575	296.5

In the test procedures shown in the Table, compositions of the present invention were prepared with two different oxygen balances and compared with analogous comparative compositions, in order to enable persons skilled in the art to make a broad-based comparison. Comparison C is equivalent to Example 2 of Barnes '183. Inventive composition A is an adjustment of Comparison C with oxygen balance. Inventive composition B changes in oxygen balance. Comparison D was prepared by changing the oxygen balance to be equivalent.

The compositions of the present invention unexpectedly generate less than half of the noxious carbon monoxide by-products generated by the analogous prior art compositions (215 cc vs. 440 cc, and 220 cc vs. 500 cc). Moreover, the total amounts of poisonous gases generated is much smaller with the compositions of the present invention than with the compositions representative of the prior art. (This is true in spite of the fact that the differences in amounts reported for ammonia are within experimental error.)

Inasmuch as nothing in any of the prior art relied upon by the Examiner in this rejection teaches or suggests that significantly smaller amounts of noxious carbon monoxide gas can be obtained with compositions containing sodium carboxymethylcellulose in place of

e.g. guar gum binder, the presently claimed invention is clearly patentable. The combinations of the Matsuda, Zhou, and Seeger references with the Barnes and Mendenhall references fail to suggest the unexpected improvement in properties (in particular, reduction in carbon monoxide emissions) provided by the present invention.

Conclusion

Withdrawal of all rejections of record is in order and is earnestly solicited. Should there be any outstanding issues to be resolved in the present application, the Examiner is respectfully requested to contact the undersigned by telephone at the number listed below.

Respectfully submitted,

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RCS/RG
0425-0851P
Exhibit A

Exhibit A

The invention with added water control with no water